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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/786,388	02/25/2004	Christof Streck	2000.110400	2900
23720	7590	08/23/2006		
WILLIAMS, MORGAN & AMERSON 10333 RICHMOND, SUITE 1100 HOUSTON, TX 77042			EXAMINER TRAN, BINH X	
			ART UNIT 1765	PAPER NUMBER
DATE MAILED: 08/23/2006				

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/786,388	<b>Applicant(s)</b> STRECK ET AL.	
	<b>Examiner</b> Binh X. Tran	<b>Art Unit</b> 1765	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 16 June 2006.
- 2a) ☒ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-3,5-11,14 and 16-29 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3,5-11,14 and 16-29 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |                                                                                                                        |                                                                                         |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                            | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____                                                |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-3, 5-11, 14, 16-29 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In claims 1, 14, 23, the examiner is unable to find the support for the new limitation "removing a native oxide layer from a surface layer of said doped region" (emphasis added). The examiner is able to find the step of removing oxide residue from the surface of the contamination layer (215) in page 12 lines 24 to page 13 lines 7 of the specification. There is no description in the specification, which defines that, the contamination layer (215) as the "native oxide".

In claim 1, 14, and 23, the examiner considers the limitation "without performing an oxidation process of said surface, removing said surface layer of said doped regions by performing an etching process" (emphasis added) as a negative limitation. Again, the examiner is unable to find the proper support for this negative limitation. According to the MPEP 2173.05(i) "Any negative limitation or exclusionary proviso must have

Art Unit: 1765

basis in the original disclosure. ....Any claim containing a negative limitation which does not have basis in the original disclosure should be rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement.” Further, contrary to the negative limitation in the claim, the applicants clearly disclose the step of performing an oxidation process using hydrogen peroxide containing solution in pages 16-19 of the specification. For example, in page 17 lines 18-20, the applicants wrote, “A corresponding process cycle, i.e. oxidation and subsequent oxide etch as described with reference to Figs 3a-3b, may be repeated until the initial contaminated layer 315 is substantially completely removed”.

Claims 2-3, 5-11, 16-22, 24-29 are rejected under 35 U.S.C. 112, first paragraph because they directly or indirectly depend on claims 1, 14 or 23.

3. Claims 1-3, 5-11, 14, 16-29 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

In claim 1, 14, 23 the examiner does not understand the contradicted limitation “without performing an oxidation process on said surface layer, removing said surface layer of said doped regions by performing an etching process using a diluted solution”. The applicants discloses the diluted etch solution comprises HF and hydrogen peroxide (claims 2, 14), or ammonium hydroxide and hydrogen peroxide (claim 3 and 23). It is well known in the art that hydrogen peroxide is a severe oxidizer (See evidence by

Art Unit: 1765

Material Safety Data Sheet for hydrogen peroxide). It is also well known in the art the mixed solution of HF and hydrogen peroxide, or mixed solution of ammonia (aka ammonium hydroxide) and hydrogen peroxide is an oxidizing/oxidizer solution (See evidence by Tsukamoto US 2001/0029074). Therefore, it is not possible to have the limitation "without performing an oxidation process on said surface layer, removing the surface layer of said doped regions by performing an etching process using a diluted etch solution" if the diluted etch solution comprises a severe oxidizer (i.e. hydrogen peroxide). For the purpose, the examiner will assume that after the step of removing the native oxide, there is no extra oxidation process besides the etching process using etching solution comprises oxidizer component.

Claims 2-3, 5-11, 16-22, 24-29 are rejected under 35 U.S.C. 112, first paragraph as failing to comply with the enablement requirement because they directly or indirectly depend on claims 1, 14 or 23.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 29 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 29 recites the limitation "said under-etch" in 23. There is insufficient antecedent basis for this limitation in the claim.

***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1, 3, 23-24, 29 are rejected under 35 U.S.C. 102(e) as being anticipated by Ryu et al. (US 2002/0146888).

Respect to claim 1, Ryu discloses a method comprising the step of:

forming a doped region of a specified doping profile in a silicon region adjacent to a gate electrode (18) having sidewall spacers (20) formed therein (Fig 1, paragraph 0021);

removing a native oxide (22) from a surface layer of said doped regions (paragraph 0021-0022);

after removing said native oxide (22) and without an extra oxidation process besides the etching process, removing a surface layer of the doped regions by performing an etching process using a diluted etch solution (paragraphs 0023, Fig 3);

epitaxially growing a silicon layer (36) on said doped regions after said surface layer is removed (paragraph 0025, Fig 5).

Respect to claim 3 and 23, Ryu teaches the diluted etch solution comprises ammonium hydroxide and hydrogen peroxide (paragraph 0023). Respect to claim 29, Ryu discloses the step of forming a metal silicide in the grown silicon layer and the

Art Unit: 1765

doped region having a lateral dimension is determined by the etching process (paragraph 0025, Fig 5). Respect to claim 24, Ryu teaches the step of cleaning the surface layer prior to removing said surface so as to remove oxide residues (paragraph 0022).

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title; if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. Claims 2, 7, 14, 18, 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ryu in view of Tsukamoto (US 2001/0029074).

Respect to claims 2, 14 Ryu fails to disclose the dilute etch solution comprise HF, hydrogen peroxide, and water. However, Ryu clearly discloses the dilute etch comprises ammonium hydroxide, and hydrogen peroxide. In a semiconductor process,

Tsukamoto teaches to use either a mixed solution of HF and hydrogen peroxide or a mixed solution of ammonium hydroxide and hydrogen peroxide (paragraph 34). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ryu in view of Tsukamoto by using HF and hydrogen peroxide solution because equivalent and substitution of one for the other would produce an expected result.

Respect to claim 7, Ryu teaches the removing said surface includes intermittently applying the etch solution and cleaning the surface layer at least one during a discontinuation of the etch solution application (paragraph 0022-0024).

The limitation of claims 18 and 22 has been discussed above under Ryu's reference.

10. Claims 5-6, 16-17, 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ryu and Tsukamoto and further in view of Bergman (US 6,830,628).

Respect to claims 5 and 16, Ryu fails to disclose that the etch solution is applied by a spray tool. However, Ryu clearly teaches the etch solution is applied by dipping. In a semiconductor process, Bergman teaches to apply the etch solution can be applied using either a spray tool or dipping tank (col. 6 lines 60 to col. 7 lines 14). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ryu and Tsukamoto in view of Bergman by using a spray tool because equivalent and substitution of one for the other would produce an expected result.

Respect to claims 6, 17 and 25, Ryu and Tsukamoto fail to teach the step of rinsing the surface layer before or after applying the diluted etch solution. Bergman



Art Unit: 1765

teaches to rinse the surface layer after applying the diluted etch solution to dislodge any residue on the surface (col. 7 lines 25-50). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ryu and Tsukamoto in view of Bergman by rinsing the surface after applying the diluted etch solution because it will help to dislodge any residue on the surface.

11a. Claims 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ryu and further in view of Gilton (US 6,437,417).

11b. Claims 19-20, 26-27, are rejected under 35 U.S.C. 103(a) as being unpatentable over Ryu and Tsukamoto and further in view of Gilton (US 6,437, 417).

Respect to claims 8, 19 and 26, Ryu or Tsukamoto fail to disclose the step of controlling the thickness of the removed surface by determining in advance an etch rate of the etch solution and adjusting an etch time. Gilton teaches the etch rate is determined in advanced for example at 250 angstrom/min (col. 6 lines 22-33). Gilton further discloses the thickness of the removed layer and the etching time are related two each other base on the known etching rate. If the etching rate and the etching time are known, then it is possible to calculate the thickness of the removed layer. It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ryu or Ryu and Tsukamoto in view of Gilton by controlling the thickness of the removed surface based on the etch rate and etching time because these parameters are related to each other. By controlling the thickness using etching rate and etching time will help us to determine to endpoint of the etching process.

Respect to claim 9, 20 and 27, Ryu fails to disclose the step of determining the penetration depth of the contaminations (i.e. doped region) in said surface. However, Ryu clearly discloses to dope ion in to the surface to form a doped region (LDD region). A doped region certainly must a thickness value. Gilton discloses the penetration depth of the doped region is about 1000 angstrom (col. 5 lines 1-7). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ryu or Ryu and Tsukamoto in view of Gilton by determining the penetration depth of the doped region because it help us to determine the thickness of this doped region.

12a. Claims 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ryu and further in view of Wang et al. (US 6,448,167).

12b. Claims 21, 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ryu and Tsukamoto and further in view of Wang et al. (US 6,448,167).

Respect to claims 10, 21 and 28, Ryu or Ryu/Tsukamoto fail to disclose the step of adjusting an under-etch of the sidewall spacers during removal of the surface layer. Wang teaches to adjust an under-etch of the sidewall spacers during the removal of the surface to create undercut region (9) (col. 4 lines 39-63, Fig 6). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ryu or Ryu/Tsukamoto in view of Wang by adjusting the under-etch in order to create undercut region of the sidewall spacers.

Respect to claims 11, Ryu discloses the step of forming a metal silicide in the grown silicon layer and the doped region having a lateral dimension is substantially determined by the etching process (paragraph 0025, Fig 5).

***Response to Arguments***

13. The applicants argue that “the present claims all explicitly recite that, after the native oxide is removed, no oxidation process is performed on the surface layer, and that an etching process is performed to remove the surface layer. If anything, Ryu can be understood to teach away from the currently pending claims.” The examiner disagrees with this argument. As discussed above, the examiner shows that it is impossible that no oxidation process is performed on the surface layer by using an etching solution comprises oxidizer (i.e. hydrogen peroxide). For the purpose of the examination, the examiner will interpret that no additional or extra oxidation process is performed besides the etching process using etching solution comprises oxidizer. Ryu clearly teaches the step of removing native oxide layer (paragraph 0022). Ryu further discloses no additional oxidation process is performed beside the etching process using ammonium hydroxide/H<sub>2</sub>O<sub>2</sub> etching solution (paragraph 0023). Further it is noted that Ryu’s etching solution is identical with applicant’s etching solution (i.e. ammonium hydroxide/H<sub>2</sub>O<sub>2</sub>). Using the same etching solution [with applicant’s etching solution] on the same material certainly will produce the same result.

The applicant’s amendment necessitates an additional new ground of rejection (i.e. 35 U.S.C. 112, first paragraph).

***Conclusion***

14. The prior art made of record and not relied upon is considered pertinent to applicant’s disclosure.

Material Safety Data Sheet, "Hydrogen Peroxide Solution"

<http://www.itbaker.com/msds/englishhtml/H4065.htm> discloses that hydrogen peroxide is an oxidizer having reactivity rating as severe. (page 2)

15. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X. Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for

Art Unit: 1765

published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should

you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

USPTO Customer Service Representative or access to the automated information

system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Binh X. Tran

NADINE NORTON  
SUPERVISORY PATENT EXAMINER  
ART UNIT 1765

